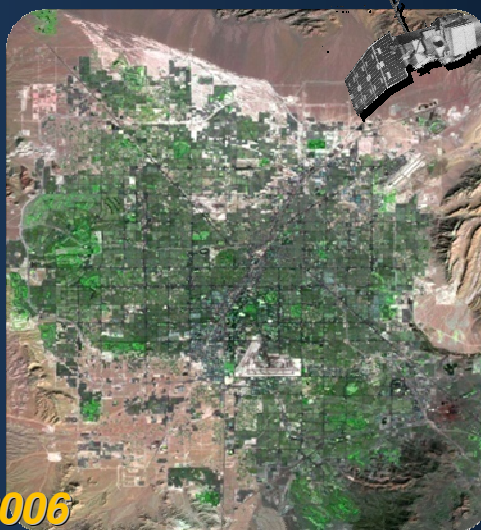


A Clear View of Society and the Environment from Space

Las Vegas, Nevada



1973



2006

33 years of land change as seen from the Landsat series of satellites.

*Prepared for
Land Processes DAAC User
Working Group Meeting*

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August 11, 2010

NASA – USGS Partnership

- NASA and USGS sign original agreement in 1988
- LP DAAC goes operational in 1994
- Starts supporting missions (Landsat & Terra) in 1999
- Data, products and services
 - Version 0, Landsat, SRTM, ASTER, MODIS, EO-1, SIR-C, ASTER GDEM
 - TerraLook
 - Clients, software
 - GloVis
- Science applications
 - eMODIS
 - ROSES proposals

Landsat Program

- Landsat is a multispectral land remote sensing program dating back to 1972
- Landsats 1-4 are no longer operating and Landsat 6 failed to reach orbit
- Landsats 5 & 7 are presently operating and well beyond their design lives
- Landsat Data Continuity Mission (LDCM) is in development and will launch in December 2012 – it becomes Landsat 8
- Planning for Landsat 9 is just getting started
- USGS has over 2.4 million Landsat images that are the only global, radiometrically accurate record of the Earth's surface available over the last 38 years
- Landsat data continuity is required by law (Land Remote Sensing Policy Act of 1992)

Many diverse uses of Landsat data include:

- | | | |
|----------------------------|------------------------|--------------------------------------|
| • Agricultural | • Deforestation | • Land Use/Land Cover Classification |
| • Mapping | • Global Change | • Famine Early Warning |
| • Fire/Disaster Management | • Flood management | • Glacier Monitoring |
| • Carbon Inventory/Credits | • National Security | • Insurance Risk Management |
| • Land Use Planning | • Ecosystem Management | • International Treaty Management |

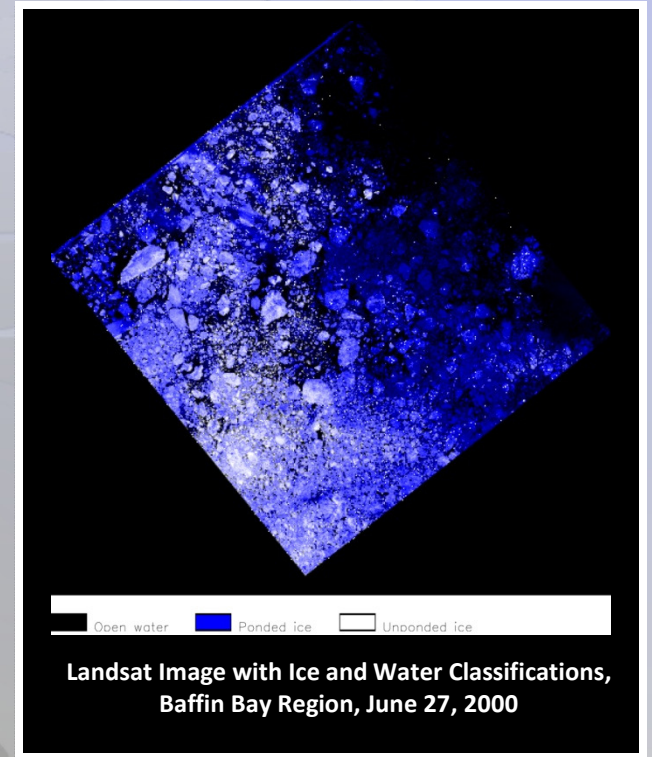
Landsat 9 and Beyond

- USGS has served as the Landsat data steward since program's inception in 1966
 - experienced several changes in program leadership, including two unsuccessful attempts to commercialize the satellites
- USGS Joined NASA in 2000 as full partner in program management
 - Presidential Decision Directive NSTC-3 (5/94, revised 10/00)
- NASA and USGS funded for Landsat 8 development; funding projected for USGS operations through 2017
- No agency yet has responsibility or funding for Landsat 9 or beyond
 - NASA is not responsible for “operational” satellites
 - NASA has developed and launched NOAA operational satellites with NOAA funds
 - NOAA operational environmental satellites observe oceans & atmosphere
 - 8 Federal agencies recommend that Department of the Interior/USGS manage the Landsat program and NASA build and launch Landsat 9 and beyond (see *A Plan for a U.S. National Land Imaging Program*, National Science and Technology Council, 2007)
- Definition of Landsat 9 needs to start in FY12 to support a launch in FY17
- Integrate Decadal Survey Mission technology into Future Landsat Missions
 - HypsIRI

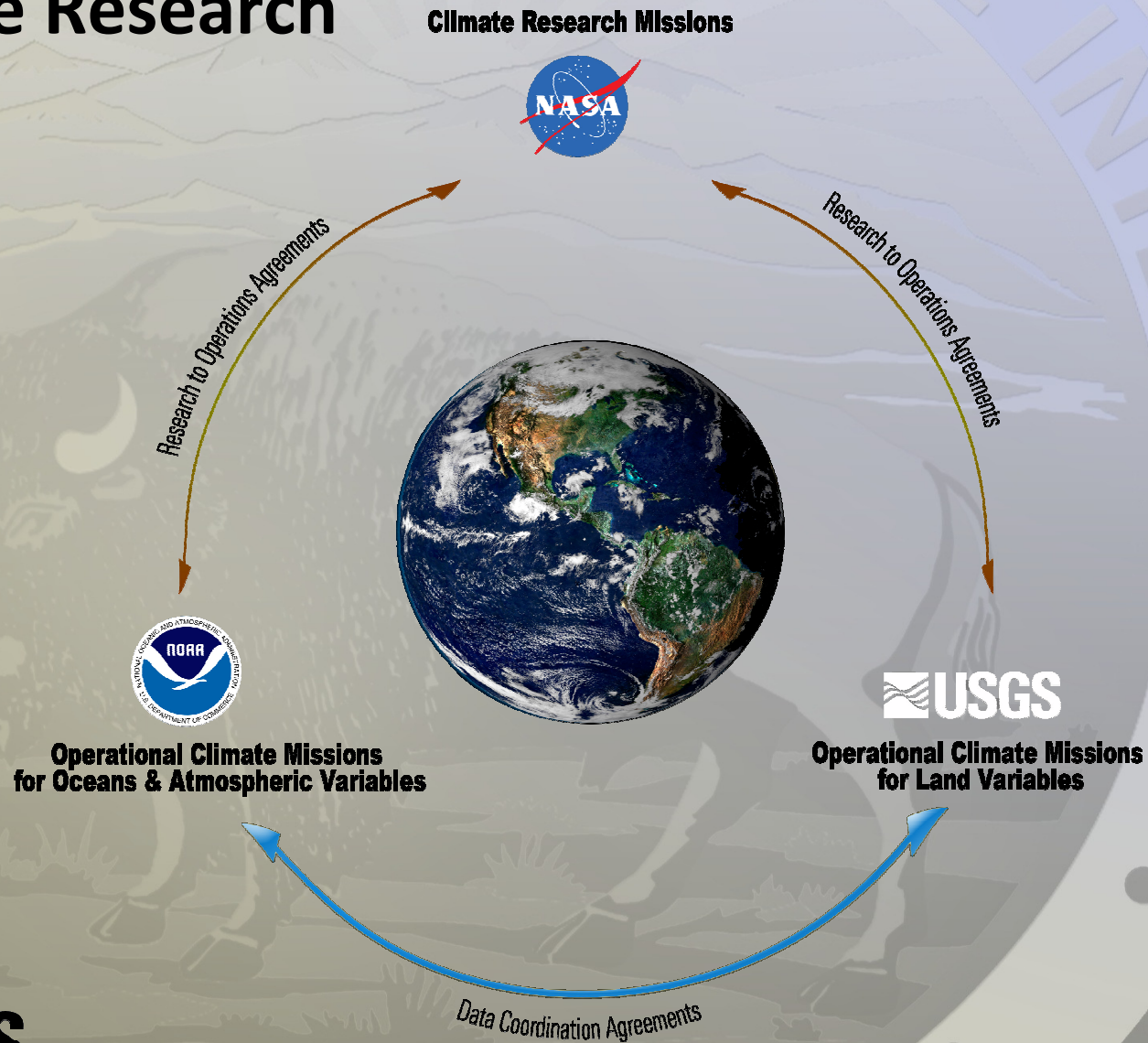
Landsat Remote Sensing of Global Change

Role in Global Change Research

- Impacts of land use and land cover change
 - Carbon cycle dynamics
 - Changes in ecosystem services, e.g., deforestation
- Monitoring climate-driven land dynamics
 - Changes in snow and ice extent, e.g., glaciers
 - Changes in fire frequency and severity
 - Drought cycles
- Climate studies
 - Human dimensions of global change
 - Land-atmosphere interactions
 - Land use modifications of weather and climate
- Essential Climate Variables (ECVs) - Terrestrial
 - River discharge, Water use, Ground water, Lake levels, Snow cover, Glaciers and ice caps, Permafrost and seasonally-frozen ground, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (fPAR), Leaf area index (LAI), Biomass, Fire disturbance, Soil moisture



Practical Framework for Space-based Global Change Research



Terrestrial Monitoring for Land Surface Change

- USGS development of climate data records (CDRs) and essential climate variables (ECVs) is driven by needs to quantify land surface change in response to natural and human influences
- Builds upon a significant body of work based on coarse resolution data (e.g. AVHRR, MODIS)
- Exploit the uniqueness of the Landsat data record (37+ years)
- Responsive to National and International needs
- NASA/USGS partnership is essential

Candidate Landsat Terrestrial ECVs

Terrestrial ECV	Technical Consideration			Requirements / Demand		
	Landsat Potential	USGS Readiness	USGS Uniqueness	USGS Relevance	Importance to DOI	Overall Community Demand
*Land Cover	High	High	High	High	High	High
*Leaf Area Index	High	Low	Low	Medium	Medium	Medium
FPAR	High	Low	Low	Medium	Low	Low
Biomass	Low	Low	Low	High	High	High
*Albedo	Medium	Low	Low	Medium	Low	Low
*Fire Disturbance	Medium	High	Medium	High	High	High
*Surface Water	High	High	Medium	High	High	Medium
*Snow / Ice	Medium	Medium	Low	Medium	Medium	Medium
Soil Moisture	Low	Medium	Low	Medium	Medium	Medium

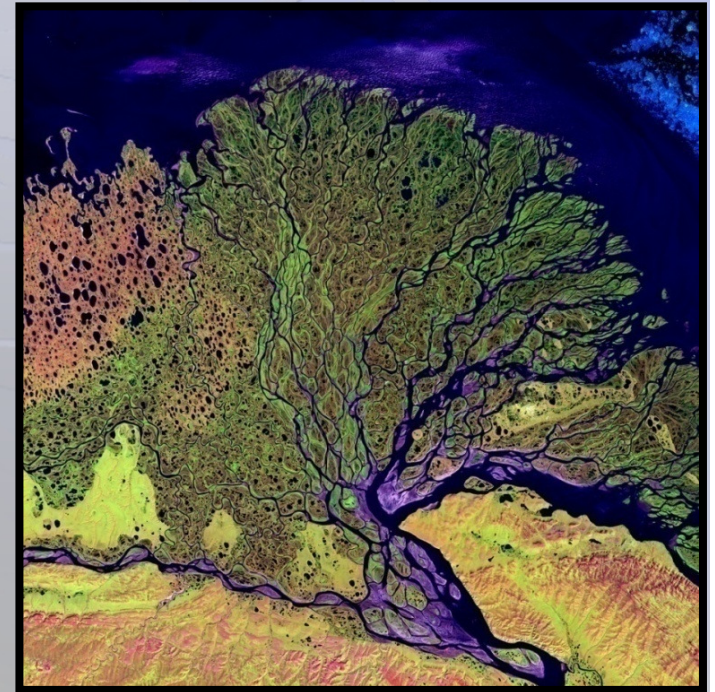
*ECVs with highest initial potential for development

ECV Partnerships with NASA

- Landsat Ecosystem Disturbance Adaptive Processing System (LEDAPS) – Jeff Masek, NASA GSFC
 - Process current and historical Landsat data to retrieve surface reflectance and quantify measures of forest disturbance
 - Atmospheric correction approach is applicable to historical Landsat ETM+ and TM data
- Deriving Biophysical Products from Landsat Data – Rama Nemani, NASA Ames Research Center
 - Prototyping leaf area index (LAI) as an essential climate variable (ECV) to support ecosystem monitoring and forecasting
 - Phased approach to processing current and historical Landsat data
 - California -> Conterminous U.S. -> North America -> Global
- Potential for distribution of CDRs/ECVs through LP DAAC

Summary

- USGS and NASA have a long and productive history in Earth observation going back to the mid-60's
- LP DAAC has been a tremendous success and demonstrates the value of the NASA/USGS collaboration
- USGS will work with NASA to bring future NASA land remote sensing missions (Decadal missions) to the LP DAAC
- USGS will work with NASA to expand the science applications and education activities of these data sets
- USGS will work with NASA to transition LP DAAC datasets to the long-term USGS archive



Landsat 7: Lena Delta

Image taken 7/27/2000 The Lena River, some 2,800 miles (4,400 km) long, is one of the largest rivers in the world. The Lena Delta Reserve is the most extensive protected wilderness area in Russia. It is an important refuge and breeding grounds for many species of Siberian wildlife.